

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

LISTING OF CLAIMS

1. (Currently Amended) A CPP giant magnetoresistive head comprising:
lower and upper shield layers with a predetermined shield distance
therebetween;

a giant magnetoresistive (GMR) element disposed between the upper and lower shield layers, the GMR element having a group of adjacent parallel layers, the group comprising a pinned magnetic layer, a free magnetic layer and a nonmagnetic layer disposed between the pinned magnetic layer and the free magnetic layer, the CPP giant magnetoresistive head being free of an antiferromagnetic layer between the upper and lower shield layers that passes generally perpendicularly through a vertical plane drawn through the group of adjacent parallel layers in a thickness direction, wherein a current flows in a direction of the vertical plane; and

wherein the pinned magnetic layer includes a laminated ferrimagnetic structure comprising a first pinned magnetic sublayer and a second pinned magnetic sublayer which are laminated with a nonmagnetic intermediate layer disposed therebetween, wherein the pinned magnetic layer extends to a rear of the nonmagnetic layer and the free magnetic layer, in a height direction, and a dimension of the pinned magnetic layer in a height direction is larger than that in a track width direction, wherein the pinned magnetic layer comprises a magnetic material having a positive magnetostriction constant, and an end of the pinned magnetic layer is exposed at a surface facing a recording medium.

2. (Cancelled)

3. (Currently Amended) The CPP giant magnetoresistive head according to claim 1, wherein the first and second pinned magnetic sublayers partially or entirely comprise Fe-Co-Cu (wherein Fe > 10 atomic percent, Co > 30 atomic percent, and Cu >

5 atomic percent), Fe-Co-Cu-X (wherein X is at least one element of Pt, Pd, Mn, Si, Au, and Ag), or Co₂MnY (wherein Y is at least one element of Ge, Si, Sn, and Al).

4. (Withdrawn) The CPP giant magnetoresistive head according to claim 1, further comprising an antiferromagnetic layer provided in a rear of the giant magnetoresistive element in the height direction, for pinning the magnetization direction of the pinned magnetic layer in the height direction.

5. (Withdrawn) The CPP giant magnetoresistive head according to claim 4, wherein the antiferromagnetic layer is an insulating antiferromagnetic layer comprising Ni-O or α -Fe₂O₃.

6. (Withdrawn) The CPP giant magnetoresistive head according to claim 4, wherein the antiferromagnetic layer comprises an insulating antiferromagnetic comprising Ni-O or α -Fe₂O₃ and an antiferromagnetic metal layer interposed between the insulating antiferromagnetic layer and the pinned magnetic layer.

7. (Currently Amended) A CPP giant magnetoresistive head comprising:
lower and upper shield layers with a predetermined shield distance therebetween;
a giant magnetoresistive (GMR) element disposed between the upper and lower shield layers, the GMR element having a group of adjacent parallel layers, the group comprising a pinned magnetic layer, a free magnetic layer and a nonmagnetic layer disposed between the pinned magnetic layer and the free magnetic layer, the CPP giant magnetoresistive head being free of an antiferromagnetic layer between the upper and lower shield layers that passes generally perpendicularly through a vertical plane drawn through the group of adjacent parallel layers in a thickness direction, wherein a current flows in a direction of the vertical plane; and

The CPP giant magnetoresistive head according to claim 1, further comprising large-area nonmagnetic metal films provided between the giant magnetoresistive element and the lower shield layer and between the giant magnetoresistive element and the upper shield layer, respectively, so that the large-area nonmagnetic metal films are

in direct contact with the pinned magnetic layer and the free magnetic layer and have larger areas than those of the pinned magnetic layer and the free magnetic layer, respectively,

wherein the large-area nonmagnetic metal films are in direct contact with the lower shield layer and the upper shield layer respectively,

wherein the pinned magnetic layer includes a laminated ferrimagnetic structure comprising a first pinned magnetic sublayer and a second pinned magnetic sublayer which are laminated with a nonmagnetic intermediate layer disposed therebetween, and

wherein the pinned magnetic layer extends to a rear of the nonmagnetic layer and the free magnetic layer, in a height direction, and a dimension of the pinned magnetic layer in a height direction is larger than that in a track width direction.

8. (Currently Amended) The CPP giant magnetoresistive head according to claim 7, wherein the large-area nonmagnetic metal film disposed between the giant magnetoresistive element and the lower shield layer comprises any one of Ta/Cu, Ta/Ru/Cu, Ta/Cr, Ta/Ni-Cr, Ta/(Ni-Fe)-Cr, and Cr, and ~~wherein~~when the composition contains Cr, the Cr content exceeds 20 atomic percent.

9. (Currently Amended) A CPP giant magnetoresistive head comprising;
lower and upper shield layers with a predetermined shield distance therebetween;

a giant magnetoresistive (GMR) element disposed between the upper and lower shield layers, the GMR element having a group of adjacent parallel layers, the group comprising a pinned magnetic layer, a free magnetic layer and a nonmagnetic layer disposed between the pinned magnetic layer and the free magnetic layer, the CPP giant magnetoresistive head being free of an antiferromagnetic layer between the upper and lower shield layers that passes generally perpendicularly through a vertical plane drawn through the group of adjacent parallel layers in a thickness direction, wherein a current flows in a direction of the vertical plane; and

wherein the pinned magnetic layer has a laminated ferrimagnetic structure comprising a first pinned magnetic sublayer and a second pinned magnetic sublayer which are laminated with a nonmagnetic intermediate layer disposed therebetween, wherein the pinned magnetic layer comprises a magnetic material having a positive magnetostriction constant ~~or a magnetic material having high coercive force~~, and an end of the pinned magnetic layer is exposed at a surface facing a recording medium.

10. (Previously presented) The CPP giant magnetoresistive head according to claim 9, wherein a dimension of the pinned magnetic layer in a height direction is larger than the dimension in a track width direction.

11. (Currently Amended) The CPP giant magnetoresistive head according to claim 9, wherein the first and second pinned magnetic sublayers partially or entirely comprise Fe-Co-Cu (wherein Fe > 10 atomic percent, Co > 30 atomic percent, and Cu > 5 atomic percent), Fe-Co-Cu-X (wherein X is at least one element of Pt, Pd, Mn, Si, Au, and Ag), or Co₂MnY (wherein Y is at least one element of Ge, Si, Sn, and Al).

12. (Withdrawn) The CPP giant magnetoresistive head according to claim 9, further comprising an antiferromagnetic layer provided in a rear of the giant magnetoresistive element in the height direction, for pinning the magnetization direction of the pinned magnetic layer in the height direction.

13. (Withdrawn) The CPP giant magnetoresistive head according to claim 12, wherein the antiferromagnetic layer is an insulating antiferromagnetic layer comprising Ni-O or α -Fe₂O₃.

14. (Withdrawn) The CPP giant magnetoresistive head according to claim 12, wherein the antiferromagnetic layer comprises an insulating antiferromagnetic comprising Ni-O or α -Fe₂O₃ and an antiferromagnetic metal layer interposed between the insulating antiferromagnetic layer and the pinned magnetic layer.

15. (Currently Amended) A CPP giant magnetoresistive head comprising:
lower and upper shield layers with a predetermined shield distance
therebetween;

a giant magnetoresistive (GMR) element disposed between the upper and lower shield layers, the GMR element having a group of adjacent parallel layers, the group comprising a pinned magnetic layer, a free magnetic layer and a nonmagnetic layer disposed between the pinned magnetic layer and the free magnetic layer, the CPP giant magnetoresistive head being free of an antiferromagnetic layer between the upper and lower shield layers that passes generally perpendicularly through a vertical plane drawn through the group of adjacent parallel layers in a thickness direction, wherein a current flows in a direction of the vertical plane; and

The CPP giant magnetoresistive head according to claim 9, further comprising large-area nonmagnetic metal films provided between the giant magnetoresistive element and the lower shield layer and between the giant magnetoresistive element and the upper shield layer, respectively, so that the large-area nonmagnetic metal films are in direct contact with the pinned magnetic layer and the free magnetic layer and have larger areas than those of the pinned magnetic layer and the free magnetic layer, respectively,

wherein the large-area nonmagnetic metal films are in direct contact with the lower shield layer and the upper shield layer respectively,

wherein the pinned magnetic layer has a laminated ferrimagnetic structure comprising a first pinned magnetic sublayer and a second pinned magnetic sublayer which are laminated with a nonmagnetic intermediate layer disposed therebetween, and

wherein the pinned magnetic layer comprises a magnetic material having a positive magnetostriction constant, and an end of the pinned magnetic layer is exposed at a surface facing a recording medium.

16. (Original) The CPP giant magnetoresistive head according to claim 15, wherein the large-area nonmagnetic metal film disposed between the giant magnetoresistive element and the lower shield layer comprises any one of Ta/Cu, Ta/Ru/Cu, Ta/Cr, Ta/Ni-Cr, Ta/(Ni-Fe)-Cr, and Cr, and when the composition contains Cr, the Cr content exceeds 20 atomic percent.

17. (Currently Amended) A CPP giant magnetoresistive head comprising:
lower and upper shield layers with a predetermined shield distance
therebetween;

a giant magnetoresistive (GMR) element disposed between the upper and
lower shield layers, the GMR element having a group of adjacent parallel layers, the
group consisting of a pinned magnetic layer, a free magnetic layer and a nonmagnetic
layer disposed between the pinned magnetic layer and the free magnetic layer, wherein
the pinned magnetic layer includes a laminated ferrimagnetic structure consisting of a
first pinned magnetic sublayer and a second pinned magnetic sublayer which are
laminated with a nonmagnetic intermediate layer disposed therebetween; and

large-area nonmagnetic metal films abutting against the GMR element
and the lower shield layer and between the GMR element and the upper shield layer,
respectively, so that the large-area nonmagnetic metal films are in direct contact with
the pinned magnetic layer and the free magnetic layer and have larger areas than those
of the pinned magnetic layer and the free magnetic layer, respectively.

18. (Original) The CPP giant magnetoresistive head according to claim 17,
wherein the large-area nonmagnetic metal films comprise first and second large-area
nonmagnetic metal films, wherein the first large-area nonmagnetic film is located
between the upper shield layer and the free magnetic layer, and wherein the second
large-area nonmagnetic film is located between the lower shield layer and at least one
of the first and second pinned magnetic layers.

19. (Original) The CPP giant magnetoresistive head according to claim 17,
wherein the pinned magnetic layer comprises a magnetic material having a positive
magnetostriction constant or a magnetic material having high coercive force, and an
end of the pinned magnetic layer is exposed at a surface facing a recording medium.

20. (Original) The CPP giant magnetoresistive head according to claim 17,
wherein the first and second pinned magnetic layers partially or entirely comprise Fe-
Co-Cu (wherein Fe > 10 atomic percent, Co > 30 atomic percent, and Cu > 5 atomic

percent), Fe-Co-Cu-X (wherein X is at least one element of Pt, Pd, Mn, Si, Au, and Ag),
or Co₂MnY (wherein Y is at least one element of Ge, Si, Sn, and Al).